

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 83

Washington : 1936

No. 2992

CALIFORNIA CRUSTACEA OF THE ORDER CUMACEA¹

By CARL ZIMMER

Zoological Museum, University of Berlin, Berlin, Germany

THE collection of cumaceans here reported upon was obtained in the vicinity of Newport, Calif., by Prof. G. E. MacGinitie, director of the Kerckhoff Marine Laboratory of the California Institute of Technology at Corona Del Mar, Calif. Newport lies in Orange County at about latitude 33°38' N.

Knowledge of the cumacean fauna of the Pacific coast of North America is so slight that every new collection from that region contributes important information. Until now only three species have been known from the coast of California: *Bathycuma* (?) *longicaudata* Calman, from San Diego, Calif.; *Diastylopsis dawsoni* S. I. Smith, ranging from Monterey Bay, Calif., to Chignik Bay, Alaska; and *Colurostylis* (?) *occidentalis* Calman, from Monterey Bay, Calif., to Oregon. Only the last of these is represented in the present collection, while each of the other seven species represented proves to be new.

The genus *Cyclaspis* was hitherto unknown from the North American-Pacific region, and the genera *Procampylaspis* and *Oxyurostylis* were unknown from the entire Pacific region. Of the latter, only the typical species, *O. smithi* Calman, which is found only on the Atlantic-American coasts from Louisiana to Casco Bay, Maine, was known.

¹ Translated from the German by Coates W. Shoemaker, Smithsonian Institution.

By the discovery of the new *Hemiteles propus* (*H. californicus*), the number of species of the group *Lamproptus*-*Hemiteles propus* found in the Pacific region is increased by one. Eight species had previously been described from that region, and I know of three additional new species from Russian material now in press, making a total of 12. When it is considered that from the much better investigated North Atlantic region only nine species of the group are known, to which four more from the southern seas may be added, the role that this group plays in the North Pacific region can be better appreciated.

Genus CYCLASPIS Sars

CYCLASPIS NUBILA, new species

FIGURE 34

Adult female.—The thoracic portion of the body is nearly as long as the abdominal. The carapace approximates three-tenths of the length of the body. The ocular lobe is distinct and reaches to the end

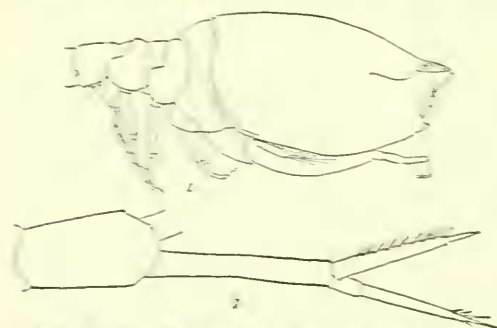


FIGURE 34.—*Cyclaspis nubila*, new species. 1, Adult female, anterior end of body. Carapace from $\times 15$; 2, same, posterior end; 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

of the pseudorostrum. The eye is strongly pigmented, nearly black. Lenses are indistinctly seen only in the hinder part. Subrostral notch distinct and deep, subrostral tooth acute. The carapace is finely and sharply pitted as if pricked with a needle, a form of ornamentation that is also repeated on the second free thoracic somite.

A median carina runs the length of the carapace, and is also rather well developed on the second free thoracic somite. On the last three free thoracic somites the median carina is less well developed, and, as it approaches the posterior extremity of the abdomen, it becomes still more indistinct.

The hinder margin of the carapace and the second free thoracic somite stand in such close juxtaposition that the first free thoracic somite is visible only as a narrow band in its dorsal median portion and on each side posterior to the lower half of the hinder margin of the carapace. Here the visible portion of the first somite is somewhat wider, because the anterior margin of the second is recessed or excavate at this point.

The anterior margin of the second free thoracic segment in lateral view appears as high as the carapace. Posteriorly it falls off gradually to meet the dorsum of the third somite. Its posterior margin in dorsal view is produced to form an obtuse angle fitting into the anterior margin of the following somite, which is shaped to receive it.

The articulation between the antepenultimate and penultimate joints of the first pereopod reaches about as far forward as the tip of the pseudorostral tooth. The basis is distinctly longer than the distal joints taken together and carries no distally projecting tooth. The last three joints are to one another approximately as 9 : 10 : 6.

The uropods (fig. 34, *b*) are about as long as the penultimate abdominal somite. Their peduncle attains about $1\frac{1}{4}$ times the length of the last abdominal somite. The exopod is fully two-thirds as long as the peduncle. The endopod is somewhat shorter than the exopod. On its inner margin there are about nine spines; distally it is not pointed but truncate and armed with a strong terminal spine.

Color.—The alcoholic specimen shows traces of its former coloring in lighter or darker brown areas. The subrostral angle is quite dark, and from it extends a narrow brown stripe, at first about parallel with and a little removed from the edge of the subrostral notch and then turning off to run down toward the ocular lobe. An indistinct brown spot is present on the mid dorsum of the posterior end of the carapace. The second and third free thoracic somites are somewhat mottled or beclouded in color but unsymmetrically so. The coloration on the last thoracic and first abdominal somites is more distinct. Finally, traces of pigmentation still persist on the first three pairs of pereopods.

Length.—About 6 mm.

Occurrence.—A single adult female, the unique holotype (U.S.N.M. no. 71437) is from off Corona Del Mar, Calif., 7 fathoms, May 17, 1933 (no. 33).

Remarks.—For the many and diverse species of the genus *Cy-claspis*, Calman² gives a key in which our new species falls into the same category (B, a, *b*, B'—b'—2) with *C. levis* G. M. Thomson. These two species possess the following characters in common (certain characters are also added here on the basis of later described species): Eye present, carapace wholly smooth, without ridges, ribs, or folds, without large tubercles, without strong teeth on the mid-dorsal carina, peduncle of the uropods not more than twice as long as the branches, basis of the first pereopod without projecting tooth at the end, carapace less than one-third as long as the entire body, basis of the first pereopod not twice as long as the distal joints taken together.

² Trans. Zool. Soc. London, vol. 18, pt. 1, no. 1, p. 6. 1907.

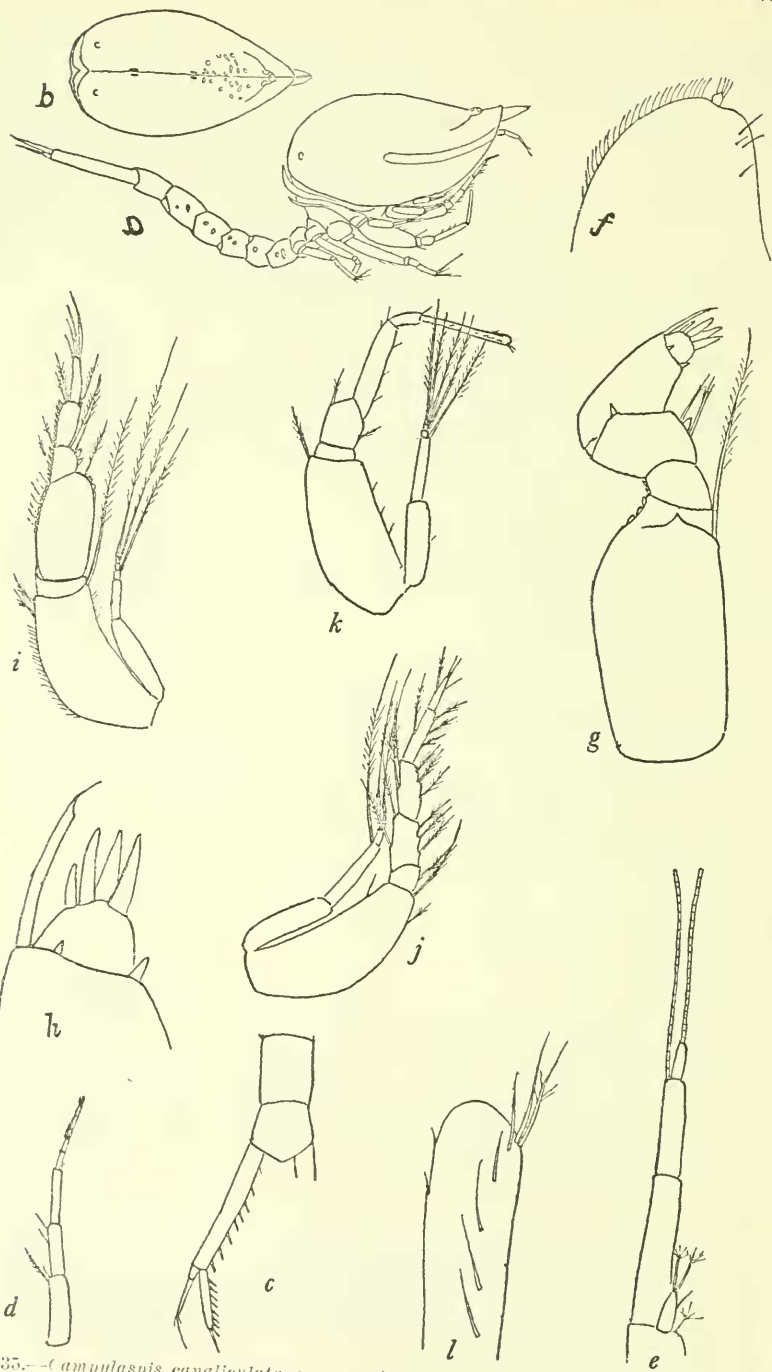


FIGURE 35.—*Canthylaspis canaliculata*, new species, adult female: *a*, Lateral view, $\times 15$; *b*, anterior end of body from above, $\times 15$; *c*, posterior end, $\times 22$; *d*, antennule, $\times 45$; *e*, end of antennule, $\times 190$; *f*, distal end of first maxilliped, $\times 190$; *g*, second maxilliped, $\times 114$; *h*, distal end of second maxilliped, $\times 310$; *i*, third maxilliped, $\times 45$; *j*, first pereopod, $\times 45$; *k*, second pereopod, $\times 45$; *l*, distal end of second pereopod, $\times 290$. (Magnifications approximate.)

Until now the only other species in this category has been *C. levis* Thomson, from which the new one is distinguished among other characters by the fact that the endopod of the uropods is not pointed but armed with a terminal spine. The following species of the genus likewise show a terminal spine at the end of the endopod: *carinata* C. Zimmer, *costata* Calman, *longipes* Calman, *picta* Calman, *unicornis* Calman, and *varians* Calman. These may be distinguished from the new species as follows: In *carinata*, *picta*, and *varians* the pseudorostral lobes distinctly unite in advance of the ocular lobe to form a pseudorostrum; *costata* has longitudinal ribs on the sides of the carapace; and *unicornis* has a forwardly directed tooth in the middle dorsal carina of the carapace. (The structure of the endopod of the uropod of *C. sibogae* Calman is not known. This species shows distinct ridges on the carapace.) The relative length of the carapace of *C. pusilla* G. O. Sars differs very slightly from that of *C. nubila* and also exhibits certain other similarities. The former, however, is essentially a smaller species, the length of the female with the brood pouch being 3.5 mm.

Genus CAMPYLASPIS Sars

CAMPYLASPIS CANALICULATA, new species

FIGURE 35

Female.—The thoracic portion of the body is almost as long as the abdominal, including the peduncle of the uropod. Viewed from above (fig. 35, *b*), the carapace is moderately pointed anteriorly. There is no subrostral notch. From the pseudorostral margin a relatively narrow but distinct furrow or groove, the margins of which are not developed as folds, runs backward and somewhat upward for about half the length of the carapace. On either side, near the hinder margin of the carapace, is a tiny pit or depression. Otherwise the carapace is entirely smooth, without sculpture. On the well-developed ocular lobe one sees a distinct median lens and two more or less distinct lateral lenses. A fine suture is evident along the median line of the carapace; this is also present on the abdomen. Its course, however, is not quite straight, but in very flat irregular curves. The roundish or elongate refractive flecks on the surface of the carapace that occur so often in members of this genus are present in this species also. There is a patch of them behind the frontal lobe. Alongside the median suture in the posterior third of the carapace there is an elongated spot or fleck. Similar small spots are also present on the abdominal somites.

The first free thoracic somite, as in a number of other species of the genus, forms a median, lobelike, pointed projection, turned forward and fitting into a corresponding notch in the posterior margin

of the carapace. A similar projection occurs also on the second thoracic somite. These projections, especially the first, are of considerable length.

The antennule (fig. 35, *d, e*) is slender. The first article of the peduncle is somewhat longer than either of the other two, which are subequal. The accessory flagellum is, as usual, very small.

The terminal joint of the first maxilliped (fig. 35, *f*) is very tiny. The basis of the second maxilliped (fig. 35, *g, h*), ventrally near the distal end projects as an angular dentiform edge, which, however, does not carry over to the outer margin. It probably represents the line of fusion between the basis and ischium. The outer margin shows a few low denticles near its end. On the outer margin of the merus there are a few similar denticles. The carpus has a strong tooth on its inner margin, and anteriorly a somewhat weaker tooth on the ventral side. The anterior margin of the propodus has two small teeth below and two bristles above. At the distal end of the outer margin there is a long powerful spine of peculiar structure. At first it diminishes gradually toward the tip, and then near its extremity undergoes a sudden contraction on the inner side, so that the spine distally forms a fine bristlelike structure that surpasses the terminal spines of the dactyl. At the end of the dactyl are four strong spines, a shorter one externally, with three longer ones on the inner side; of these the middle spine stands somewhat out of the line of the series, a little more toward the dorsal side than the others.

The basis, ischium, and merus of the third maxilliped (fig. 35, *i*) are broad; the following joints are slenderer. The basis is noticeably shorter than the distal portion of the limb. The inner margin of the merus is practically straight. The distal half of this inner margin is furnished with a row of low denticles. The outer edge likewise carries a few denticles in its distal portion. The carpus has a row of denticles on the inner margin and two small denticles on the outer. The propodus exhibits denticles only on the inner margin, while the dactyl is devoid of them.

The basis of the first pereopod (fig. 35, *j*) is shorter than the distal part of the limb. The carpus and the propodus are of nearly equal length and longer than the dactyl. None of the joints has marginal denticles.

Of the last three joints of the second pereopod (fig. 35, *k, l*), the carpus is scarcely shorter than the dactyl, while the propodus, as usual, is short, only about half the length of either of the other two joints. The dactyl is peculiar in not diminishing toward its end, indeed widening out somewhat instead. The distal extremity is rounded off and is without terminal bristles. A few bristles, however, do occur just before the end of the joint on its inner margin.

The peduncle of the uropods (fig. 35, *c*) is about as long as the last two abdominal segments taken together. On its inner margin there are about seven spines. The endopod is about half as long as the peduncle and on its inner margin also carries about seven spines. The exopod is, as usual, slenderer and shorter than the endopod.

Length.—About 4 mm.

Occurrence.—Between Balboa and Corona Del Mar, Calif., 7–15 fathoms, March and May 1933 (no. 28), two specimens, a female with brood pouch and an adult female (holotype, U.S.N.M. no. 71438), together with two specimens of *Oxyurostylis pacifica*.

Remarks.—The species is readily distinguished from all other hitherto known species by the hollowed-out groove on its carapace. *Campylaspis sulcata* has a similar groove, but it is wider, with its margin either side forming more or less of a ridge or fold.

Genus PROCAMPYLASPIS *Bonnier*

PROCAMPYLASPIS *species*

Occurrence.—Off Balboa, Calif., 15 fathoms, February 16, 1933 (no. 31), a female with brood pouch. The specimen undoubtedly represents a new species. The carapace has on each side a wide longitudinal groove extending about two-thirds the length of the carapace. The dorsum between the two grooves carries a number of not very pronounced tubercles. Three larger but much flattened tubercles are present close to the posterior margin of the carapace, the largest in the middle between the smaller lateral ones. The specimen is somewhat damaged and is thickly encrusted with sand, which cannot be removed without further harm. For this reason I refrain from basing the description of a new form upon it and leave it unnamed.

Genus HEMILAMPROPS *Sars*

HEMILAMPROPS (?) CALIFORNICA, *new species*

FIGURE 36

Female with brood pouch.—The thoracic portion of the body is somewhat longer than the abdomen, with the exception of the telson. The carapace is as long as the first four free thoracic somites taken together. In lateral view its anterior and upper margins appear to meet at right angles. From above (fig. 36, *b*) it appears anteriorly broadly truncate. A subrostral notch is scarcely perceptible. On either side of the carapace is an arched fold, which, beginning at the pseudorostral margin, runs obliquely backward and upward and, bending around in a symmetrical turn, back anteriorly to merge with the median carina found on the frontal lobe. The ocular lobe is distinct and large. On it are seven lenses, one in the center,

with six disposed in a ring about it. The pseudorostral lobes are juxtaposed but for a very short distance in front of the ocular lobe.

The telson (fig. 36, *c*) is longer than the penultimate somite of the abdomen but not so long as the last two somites taken together. Distally there are three or four spines on the lateral margin; apically there are three spines, of which the median is much longer than either of the lateral ones. Below, and somewhat external to the two lateral spines, there are two other long, practically bristlelike spines.

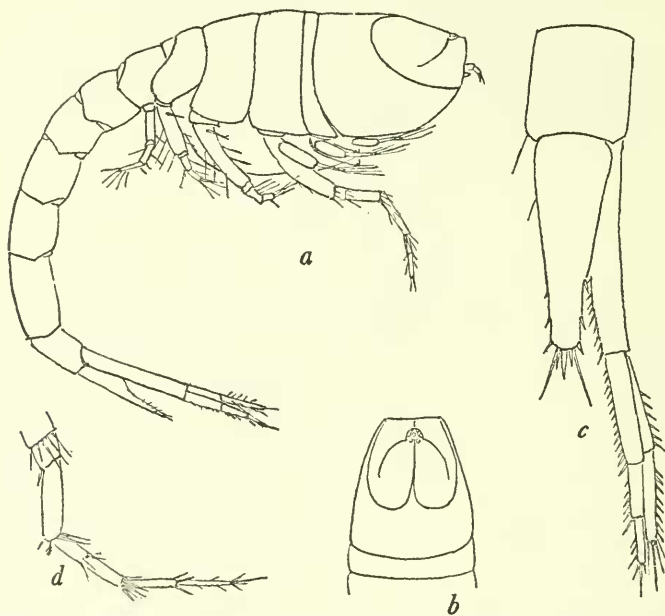


FIGURE 36.—*Hemilamprops californica*, new species, female with brood pouch: *a*, Lateral view, $\times 19$; *b*, anterior end of body from above, $\times 19$; *c*, posterior end, $\times 33$; *d*, distal end of second pereiopod, $\times 33$. (Magnifications approximate.)

The first pereiopod was lacking in all the specimens at hand. The second pereiopod (fig. 36, *d*) is moderately long. The length of its three distal joints is approximately as 19 : 14 : 12.

The peduncle of the uropods (fig. 36, *c*) extends very slightly beyond the telson. The endopod is about as long as the peduncle. The exopod shorter. Of the three joints of the endopod, the first is somewhat longer than the other two taken together; the terminal joint is somewhat shorter than the penultimate. On the inner margin of the peduncle and of the endopod there is a relatively dense armature of spines; on the inner margin of the exopod setae, on the outer margin spines.

Length.—One specimen has a length of about 8 mm. The other two are smaller, about 6 and 5.5 mm long, respectively.

Occurrence.—Off Corona Del Mar, Calif., 7 fathoms, May 17, 1933 (no. 32), a female with brood pouch, together with a specimen of *Colurostylis* (?) *occidentalis*. Between Balboa and Corona Del Mar, 17-33 fathoms, May 17, 1933 (nos. 26, 30), two females with brood pouches. Holotype, U.S.N.M. no. 71439.

Remarks.—Lacking a male, I cannot say with certainty whether the species belongs to *Hemilamprops* or *Lamprops*. As the suborbital notch is but slightly developed, I place it with *Hemilamprops* with a question mark. (*Lamprops carinata* Hart tends to bridge the gap between the two genera. The male has no pleopods—a *Lamprops* character—but has well-developed and not shortened antennal flagella—a *Hemilamprops* character.)

In possessing a single oblique fold on the carapace, the new species agrees with *Hemilamprops uniplicata* G. O. Sars and with *Lamprops* (?) *beringi* Calman. Both, however, lack the reverse forwardly directed branch of this fold. The armature of the telson, as well as the relative length of the three distal joints of the second pereopods, is also different. In *L.* (?) *beringi*, moreover, there is a distinct subrostral notch with an acute-angled subrostral tooth.

Genus DIASTYLIS Say

DIASTYLIS CALIFORNICA, new species

FIGURE 37

Female with brood pouch.—The thoracic portion of the body is somewhat longer than the abdominal but shorter than the abdomen and telson together. The abdominal portion is quite sharply set off from the broader and higher thoracic portion.

On the ocular lobe three indistinct lenses may be distinguished. There is a distinct subrostral notch. The subrostral angle is but narrowly rounded.

The margin of the subrostral notch carries several anteriorly directed plumose setae. The margin of the suborbital angle is only indistinctly denticulate, although the margin of the carapace a little farther back (behind carina no. 2 described below) has a short row of long slender teeth.

The carapace is pronouncedly and characteristically sculptured, showing strong elevated ridges or keels, enclosing between them noticeably excavate or depressed areas. At two places on either side of the carapace, three such keels run together. The angles (in the stereometric sense) thus formed by these keels rise well above the general surface of the carapace, almost forming blunt teeth. One of the angles (no. 1) lies just before the end of the frontal lobe but at some distance from it; the second (angle no. 2) is a little distance behind the end of the frontal lobe. From angle

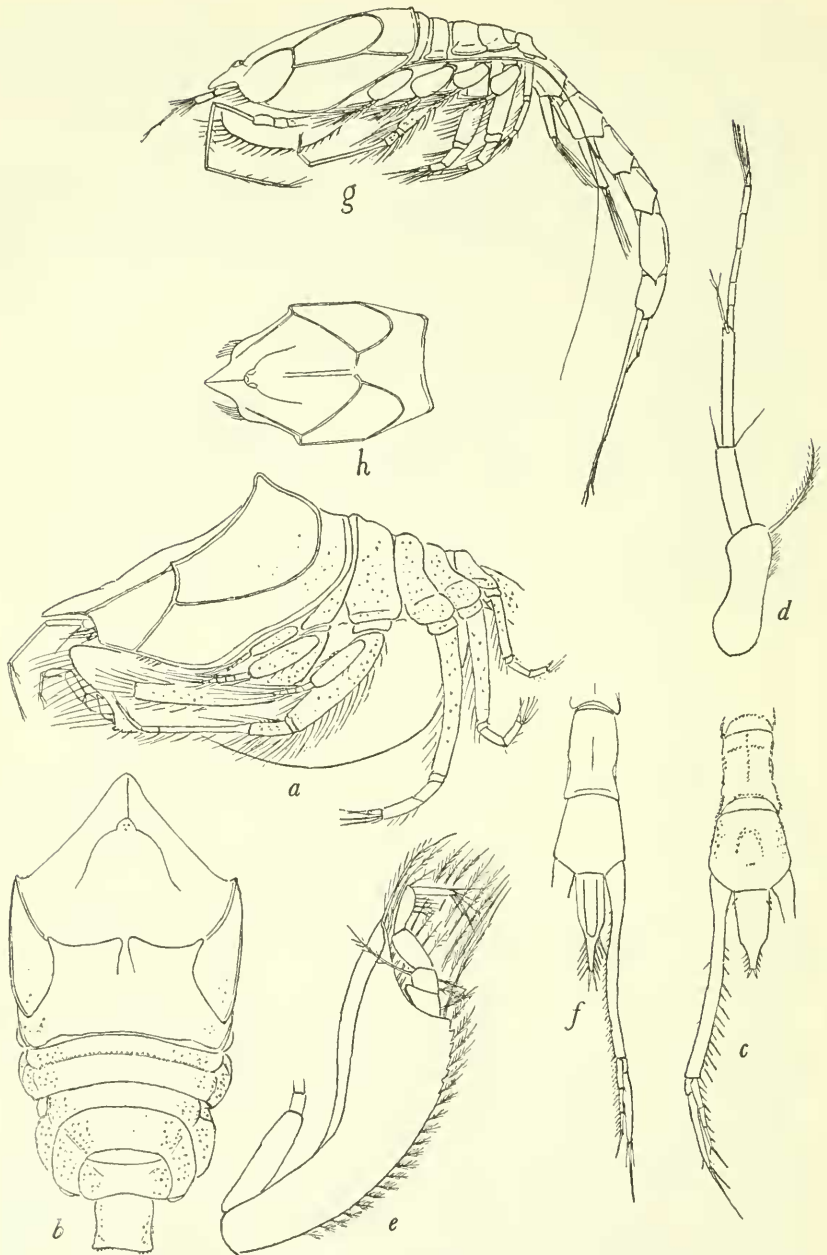


FIGURE 37.—*Diastylis californica*, new species: *a*, Female with brood pouch, anterior end of body, lateral view, $\times 13$; *b*, female with brood pouch, anterior end of body from above, $\times 13$; *c*, female with brood pouch, posterior end, $\times 13$; *d*, female with brood pouch, antennule, $\times 33$; *e*, female with brood pouch, third maxilliped, $\times 25$; *f*, male in nuptial dress, posterior end, $\times 13$; *g*, male in nuptial dress, lateral view, $\times 9$; *h*, male in nuptial dress, carapace from above, $\times 9$. (Magnifications approximate.)

no. 1 a ridge or keel (keel no. 1) runs obliquely forward and terminates about at that point where the pseudorostral margin, in forming the subrostral notch, curves downward; another ridge (keel no. 2) runs obliquely outward and forward in a flat anteriorly open curve onto the ventral margin of the carapace, which it strikes a little distance behind the subrostral angle. Keel no. 3 runs obliquely backward and upward and forms a connecting ridge or keel between angles nos. 1 and 2. Running out from this angle no. 2 are also the following ridges or keels: Keel no. 4 at first runs posteriorly and then, bending outward and forward, in the latter part of its course runs practically parallel to the lower margin of the carapace but at a little distance removed from it; finally it runs up against keel no. 2 and ends at that point. Keel no. 5, forming a very flat, anteriorly open curve, extends nearly perpendicularly to the median line; it does not, however, meet its counterpart on the opposite side of the carapace, as a narrow gap or interval intervenes between the two. At this point, within the gap, the surface of the carapace is deeply impressed; this impression is briefly continued backward. In lateral view the dorsal contour of the carapace in advance of keel no. 5 suddenly slopes steeply, yet evenly, downward to the pseudorostrum.

The telson (fig. 37, *c*) is as long as the last abdominal somite, or the equally long penultimate one. In the preanal portion of the telson the lateral margins converge but slightly; on the other hand, the postanal portion, which is a little more than half as long as the preanal, narrows abruptly. On each side of the postanal portion of the telson there are about four lateral spines in addition to the terminal pair.

The antennule (fig. 37, *d*) is slender and exceeds the pseudorostrum by the last joint of its peduncle.

The basis of the third maxilliped (fig. 37, *e*) distally is markedly broadened and, moreover, its outermost portion is not inconsiderably produced; its outer margin is dorsally turned upward a little. As the "mouth-field" is considerably narrower than the combined bases of the two maxillipeds, these at their line of contact form a roof, the angle of whose ridge is higher than normal. As a consequence, most of the third maxillipeds is to be seen in lateral view (fig. 37, *a*) in this species than is usually the case. Not one of the specimens possessed a complete first pereopod. One female, however, had a first pereopod complete on the inner side except for a portion of the dactylus. The distal extremity of this particular limb is long and slender; carpus less than half as long as the basis; propodus clearly longer than the carpus. The second pereopod also is slender; last

three joints taken together are longer than the basis; last two joints taken together not quite two-thirds as long as the carpus; the dactyl longer than propodus. There are no rudimentary exopodites on the third and fourth pereopods.

The uropods (fig. 37, *c*) are long and slender. The peduncle is longer than the last two abdominal somites taken together. Its inner margin is sparsely spined; spines somewhat variable in size. The endopod is about as long as the telson; the exopod somewhat longer. The three joints of the endopod vary but slightly in length, and carry isolated spines on their inner margins.

The integument is roughened practically throughout with tiny chitinous processes or projections. These vary in size, at times even assuming the character of fine, small teeth, as on the posterior region of the carapace and also on the sides of the free thoracic and abdominal somites, as well as on the outer surface of the proximal portions of the pereopods.

Length.—About 9 mm.

Male in nuptial dress (fig. 37, *j-h*).—The differences in the body form and in the development of the extremities usually found between the males and females within the genus occur here also; the three lenses are more distinct on the ocular lobe, the setae in the subrostral notch are stronger and more numerous, and the area about the subrostral angle is clearly denticulate. On the other hand, the row of denticles on the margin of the carapace behind keel no. 2 is lacking. The keels found on the carapace of the female are present but are not nearly so high or so strongly developed, nor are the areas between them so deeply excavated. Their placement is also somewhat different: Angle no. 2 is moved farther backward and substantially nearer the median line than in the female; keel no. 1 eventually disappears anteriorly without reaching the edge of the carapace; keel no. 5 is very short. It eventually disappears toward the median line and here merges with an indistinct longitudinal keel, which runs from about the mid length of the frontal lobe to the point of juncture with keel no. 5 in the median line of the carapace. From the forwardly turned branch of keel no. 4 and, in fact, at about the point where the turn is completed, originates another keel that runs to the posterior edge of the carapace. This keel is entirely absent in the female. It corresponds with the forward-running branch of keel no. 4, of the "lateral line", which so frequently is found in the male in the family Diastylidae.

The difference in length between preanal and postanal portions of the telson (fig. 37, *f*) is not so pronounced as in the female, while the telson is proportionately longer and slenderer. It attains the length of the penultimate abdominal somite and is, like it, clearly

longer than the last somite. In addition to two terminal spines, it carries on either side of its postanal portion about five fairly long lateral spines.

The carpus of the first pereopod is noticeably shorter than the propodus and the latter is clearly shorter than the dactyl.

The peduncle of the uropod is about twice as long as the telson. The exopod is clearly shorter than the telson and the endopod is somewhat shorter than the exopod. The three joints of the endopod are successively somewhat shorter from first to last. The spines on the inner side of the peduncle and endopod are weaker but more numerous than in the female.

The integument of the male is also roughened but not so much as in the female.

Length.—About 12 mm.

Occurrence.—Between Balboa and Corona Del Mar, Calif., 10–67 fathoms, November 25, 1932, to July 1, 1933 (no. 27), three females, one the holotype (U.S.N.M. no. 71440), with brood pouch, and two adults in poor condition and incomplete; off Balboa, Calif., 66 fathoms, March 17, 1933 (no. 29), a male in nuptial dress; off Balboa, between 15 and 66 fathoms, April 10, 1933 (no. 34), one male in nuptial dress.

Remarks.—The peculiar sculpturing of the carapace in both sexes distinguishes this new species from all other representatives of the family. In the form of its telson it shows certain relationships to the genus *Makrokylindrus*; both have an almost cylindrical preanal portion distinctly longer than the postanal, which carries a few or no lateral spines. In species of *Makrokylindrus*, however, the telson is longer than the peduncle of the uropod, or at least nearly as long (with the exception of *M. acanthodes* Stebbing). Furthermore, a more or less thick armament of the carapace is the rule among these species, and spines exist at least on the pseudorostrum, especially on its anterior portion. In the species before us the carapace is indeed roughened with fine granulations or tiny denticles, but on its pseudorostrum this roughness is least developed and is practically lacking on its anterior portions. Since to me the relationship with *Makrokylindrus* appears slight, I have refrained from placing this new species in *Makrokylindrus*, as I at first had tentatively intended.

A similar form of the telson also occurs in the genus *Paradiastylis*, but here, too, no closer relationship is indicated, for the male in nuptial dress lacks the strikingly widened base of the pereopods, which is so characteristic of *Paradiastylis* and *Dimorphostylis*.

Genus *DIASTYLOPSIS* Smith*DIASTYLOPSIS TENUIS*, new species

FIGURE 38

This new species is so extraordinarily closely related to *Diastylopsis dawsoni* S. I. Smith that I shall limit the description in the main to a differential diagnosis. The body, especially the abdominal portion, is slenderer. The subrostral notch is indeed distinct, yet not so deep, owing to the fact that the subrostral angle is not so produced as to form a definite tooth. It is only denticulate, like the anterior margin of the carapace behind it. The oblique lines on the carapace and frontal lobe are present, but only the first line on the carapace is well developed throughout. The others are very weak and often scarcely or not at all perceptible. The layout of the lines also is somewhat different. The first line extends laterally somewhat nearer the margin of the carapace than indicated in Calman's drawing of *dawsoni*. The second line has the same position as in *dawsoni* but forms a continuation of the first line of the frontal lobe. This, therefore, runs farther forward than in *dawsoni*. The second line of the frontal lobe lies about in the position of the first in *dawsoni*, and therefore not on the hinder end of the frontal lobe. The third carapace-line extends in the direction of the posterior angle of the frontal lobe and thus lies more posteriorly than in *dawsoni*.

The ventral portion of the second free thoracic segment is considerably longer; anterior and posterior margins (exclusive of the articular membranes) are approximately parallel, whereas in *dawsoni* they distinctly converge ventrally. The notch in the anterior lateral margin of this somite is narrower than in *dawsoni*.

On the penultimate thoracic sternite of *dawsoni* there is a single tooth; on the last there are two teeth close together; there is also one tooth on the first abdominal sternite. Our new species has no teeth on the penultimate thoracic and the first abdominal sternite; only the last thoracic sternite bears an unpaired tooth. The posterior lateral margins of the abdominal somites are armed with a few isolated denticles.

The telson is slenderer than in *dawsoni*. Its length is about three-fourths of the last abdominal somite, which itself also is much slenderer than in *dawsoni*. Besides the two terminal spines, the telson has only two or three pairs of lateral spines; in *dawsoni* the number is greater.

The third maxilliped, as in *dawsoni*, shows a widening of the basis distally. On the other hand, our species has only one weak denticle on the inner end of the basis, not a strong projecting tooth. The ischium does project outwardly, ending bluntly, but not actually

dentiform. (The first two pairs of pereopods of either side in all the specimens were incomplete.)

The uropod-peduncle is only a little longer than the last abdominal somite and extends beyond the telson by about a third only of its own length, not by half of its length as in *dawsoni*. The subequal branches attain about two-thirds the length of the peduncle, not, as in *dawsoni*, a good half of the peduncle length. There are fewer spines on the inner margin of the peduncle and endopod than in *dawsoni*.

Length.—The female with brood pouch is about 9 mm, whereas in *dawsoni* the length of the adult female is about 14.5 mm.

Occurrence.—Off Corona Del Mar, Calif., 20 fathoms, summer of 1933 (no. 26), an adult female and three females with brood pouches, one the holotype (U.S.N.M. no. 71441).

Remarks.—Beneath the chitin of the carapace and also at intervals in other parts of the body a distinctive structural peculiarity is manifest in the shape of more or less numerous, chiefly circular, strongly refractive flecks of varying size, which at times may coalesce to form larger irregular areas. I consider this phenomenon here to be an artificial condition resulting from the method of preservation employed.

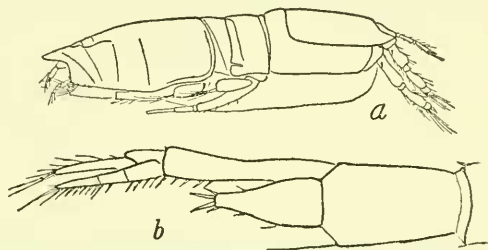


FIGURE 38.—*Diastylopsis tenuis*, new species, female with brood pouch: *a*, Anterior end of body, lateral view, $\times 9$; *b*, posterior end, $\times 25$. (Magnifications approximate.)

Genus OXYUROSTYLIS Calman

OXYUROSTYLIS PACIFICA, new species

FIGURE 39

Female with brood pouch.—The thoracic portion of the body is almost as long as the abdominal, the telson excepted. Seen from above, the carapace narrows anteriorly more regularly and evenly than in the typical species, *smithi* Calman. The subrostral notch is more developed than in *smithi*. The subrostral angle is rounded. The surface of the carapace and of the free thoracic sternites is rough, being thickly beset with very fine denticles. Only the anterior portion of the pseudorostral lobes is free of them. Two somewhat stronger denticles stand side by side in front on the ocular lobe. Two oblique impressions extend over the frontal lobe, so that in lateral view two steplike offsets are apparent. These, together with the fine denticulation of the carapace, make it appear as if there are two oblique rows of denticles on the frontal lobe.

The telson is longer than the last abdominal somite and somewhat shorter than the penultimate. On either side it carries three or four spines. The somewhat produced posterior angle of each of the two anal flaps is armed with a long bristlelike spine.

The antennule is long and slender and exceeds the tip of the pseudorostrum by the greater part of the last joint of its peduncle.

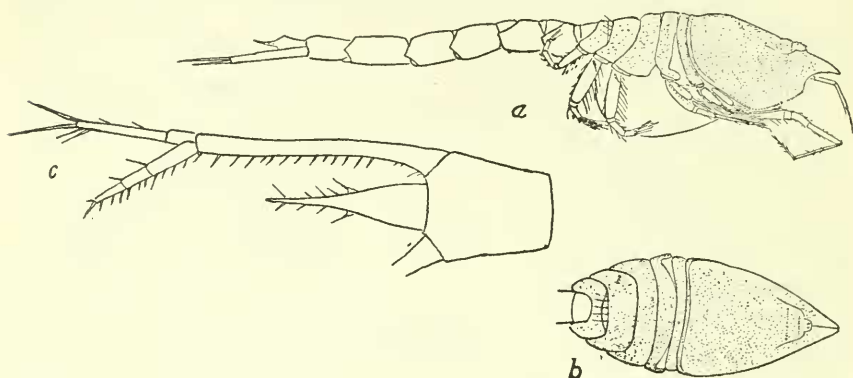


FIGURE 39.—*Oxyurostylis pacifica*, new species, female with brood pouch: *a*, Lateral view, $\times 13$; *b*, anterior end of body from above, $\times 13$; *c*, posterior end, $\times 33$. (Magnifications approximate.)

The first pereopod is long and slender and exceeds the tip of the pseudorostrum by a little more than its last two joints. Of the last three joints, the penultimate is the longest, the antepenultimate is somewhat shorter, and the last is only a little more than half as long as the penultimate.

The peduncle of the uropod exceeds the tip of the telson by almost one-third of its length. On its inner margin there are about 16 fine spines. The exopod is about as long as the endopod and attains almost half of the length of the peduncle. Of the three joints of the endopod, the first is the longest, the last is somewhat shorter, and the middle one slightly shorter yet. On the inner margin of the three joints there are, respectively, 4, 3, and 3 spines.

Length.—About 7 mm.

Occurrence.—Between Balboa and Corona Del Mar, Calif., 7–15 fathoms, March and May 1933 (no. 28), two females with brood pouches, one the holotype (U.S.N.M. no. 71442), accompanied by two specimens of *Campylaspis canaliculata*.

Remarks.—The species differs so fundamentally from *O. smithi*, the heretofore unique representative of the genus, that there is no possibility of confusing the two.

Genus COLUROSTYLIS Calman

COLUROSTYLIS OCCIDENTALIS Calman

The specimens agree well with Calman's description except that the tip of the terminal spine of the endopod of the uropod extends nearly to the end of the exopod, whereas, according to Calman, it falls somewhat short of it.

Occurrence.—Off Balboa, Calif., 33 fathoms, May 17, 1933 (no. 30), an adult male, in company with two specimens of *Hemilamprops* (?) *californica*; off Corona Del Mar, 7–20 fathoms, May 1933 (nos. 26, 33), two adult females and three females with brood pouches.





SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 83

Washington : 1936

No. 2993

A COMPARISON OF THE SHALLOW-WATER SPONGES NEAR
THE PACIFIC END OF THE PANAMA CANAL WITH
THOSE AT THE CARIBBEAN END

By M. W. DE LAUBENFELS

Pasadena, Calif.

DURING the summer of 1933 I made a study of the intertidal sponge fauna at each end of the Panama Canal.¹ Specimens were collected from intertidal waters or from waters barely below low tide, entirely without dredging. The method most frequently employed was wading and collecting by hand, but in some cases an ordinary garden rake was used from a rowboat.

The sponges of the deeper ocean differ radically from those in intertidal and shallow waters. This has been well brought out by various authors, particularly by Burton (1928). Seldom do sponges from one of these habitats venture over into the other. In general the sponges of the deeper waters of one ocean are related to those in other oceans from similar depths rather than to the adjacent shallow-water forms. The latter are likely to show more regional or local specializations than are sponges from greater depths. It was therefore deemed more important to compare the shallow-water sponges from the Atlantic end of the Panama Canal with those from the Pacific end than to make any effort to collect sponges from deeper waters farther out on either side of the isthmus.

¹ Thanks are due to Dr. James Zetek, of the U. S. Bureau of Entomology and Plant Quarantine, and to various other officials connected with the Government staff in the Panama Canal Zone who made it possible to carry on the collecting and locate suitable places for finding sponges, and to officials of the U. S. National Museum, especially Dr. Alexander Wetmore and Dr. Waldo L. Schmitt, for help and cooperation.

There are various reasons for believing that shallow-water sponges attain distribution laterally rather slowly, or at least that they are profoundly restrained by environmental barriers. In 1932 (de Laubenfels, 1932) I found considerable difference between the coastal sponges of central and southern California, and I can report subsequent (as yet unpublished) investigation in the field indicating even greater differences between the sponges of California and those of the coast only a few hundred miles north of that State, and similarly great differences between the sponges of California and Lower California. At the Pacific end of the Panama Canal there are tremendously high tides and at the Atlantic end almost no tides at all, whereas at the Atlantic end the ocean temperature is considerably higher than at the Pacific. A great difference between the faunas of the two regions was therefore to be expected. Such a difference might be due to the different ecological conditions or to independent evolutions during a geologically long period of separation. Similarities between the faunas of the two regions would be less easily explained. A marine connection until recent times might be assumed, although other reasons for this assumption are scanty. Perhaps throughout whole geologic ages sponge species neither vary much (in an evolutionary sense) nor perish as species, nor migrate away from their established locations.

Sixteen species of sponges were collected at or near the Pacific end of the Panama Canal, and 21 species were taken at the Atlantic end. Ten species were found only on the Pacific side and 15 only on the Atlantic, while six occurred in both localities. Of these six, only two are cosmopolitan; four are distinctive of this part of the world!

The Porifera of the Caribbean end show close relationship to the West Indian fauna. An astonishing number of them were new species, no less than seven, or 33 percent. In general the Pacific coasts of Central and South America have been exceedingly little studied, and it might be expected therefore that more new species would have been found in that region, but such was not the case. Only five species on the Pacific coast proved to be new, again a third of the number collected. Searching over the rocks exposed at low tide at Panama City yielded nine species and proved astonishingly similar to collecting near Plymouth, England. Four out of the nine—*Haliclona permollis*, *Halichondria panicea*, *Microciona atosanguinea*, and *Oscarella lobularis*—are forms common to both localities. Of other species occurring nearby, *Toxadocia proxima* is Arctic, *Pseudosuberites sulcatus* is Antarctic, and *Aplysilla glacialis* is both Arctic and sub-Antarctic.

Attention is called particularly to the dissimilarities between the Panama sponge fauna and that of the Pacific coast of North America in general. Of the sponges recorded from California, at least 11 per-

cent are also recorded from Puget Sound, 1,200 kilometers north, but this latter area has been less intensively studied; of a collection I made in that region in the summer of 1931, 62 percent are sponges occurring also in California. Of a collection from Lower California, nearly 1,000 kilometers south, 36 percent are species occurring also in California. From the Pacific coast of Panama, in contrast to the 62 percent and 36 percent, only 19 percent are species occurring also in California, and every one included in the 19 percent is a cosmopolitan species, not to be regarded as characteristic of any one locality. The Pacific coasts of Panama, judged from their sponge fauna, show not a trace of zoogeographical connection with those of North America but do show a little with those of Europe and with the polar regions and more yet with that small fraction of the West Indian fauna that occurs on the Caribbean coast of Panama, and finally contain a rather large proportion of species peculiar to the locality. How this compares with the west coast of South America remains to be seen.

DESCRIPTION OF PACIFIC COAST SPECIES

Genus APLYSILLA Schulze

APLYSILLA GLACIALIS (Merejkowsky)

This species is represented in the collection by U.S.N.M. no. 22211. It was found growing on wood in Balboa Harbor, beneath one of the piers. It is a thin encrustation, was rosy red in life, and is soft and fleshy; the conules are about 1 mm high and 2 to 4 mm apart. The eurypyllous flagellate chambers vary from 30μ by 60μ to 55μ by 105μ . The dendritic ascending fibers average about 50μ in diameter and arise from an extensive basal spongin plate.

The specimen is typical of the species, which was originally described from the Arctic as *Simplicella glacialis* by Merejkowsky (1878, p. 264) and later recorded from Australia by Lendenfeld (1889, p. 706). I (deLaubenfels, 1932, p. 125) recorded it from California, erroneously giving credit for the authorship to Dybowski (1880, p. 65), in which reference it appears to be a new species, but actually it had been previously described. Thiele (1905, p. 489) recorded it from the sub-Antarctic, with the opinion that his specimen was conspecific with that of Lendenfeld but not with that from the Arctic. He therefore established a new name, *Aplysilla lendenfeldi*, for the specimens south of the Equator. There seems to be no good reason for the establishment of this new name, and it is here proposed that *glacialis* be retained for the entire species. The point was made that the Arctic specimen had fewer oscules than the others and that these had somewhat raised collars around them. This is almost certainly a reaction to the current, or a lack thereof, and has little if any taxonomic value. See Bidder (1923).

The Panama sponge now being described shows no evident oscules, probably as a result of abundant current near its location, and may be regarded as typical of the race that extends from the Arctic to the Antarctic.

Genus HALICLONA Grant

HALICLONA PERMOLLIS (Bowerbank)

This species is represented in the collection by U.S.N.M. no. 22200, found growing on the extensive rocky tide flats at Panama City. It is a thin crust, drab to violet, mediocre in consistency, and without any dermal specialization. The oscules, 2 to 3 mm in diameter, are surrounded by raised collars 3 mm high. The endosome is an isodictyal reticulation of oxeas 7μ by 130μ .

This cosmopolitan species has frequently been known under the specific name of *cinerea* (Grant), but Burton (1934) chooses as the lectotype of Grant's *Spongia cinerea* a specimen that is an *Adocia*. It therefore becomes necessary to apply Bowerbank's name of *permollis* to the species, which is a typical *Haliclona*. It is well characterized by its violet color, except where environmental factors interfere with it, perhaps by causing damage, in which instances a whole range of colors tending toward drab results. Bowerbank (1866, p. 278) founded the name as *Isodictya permollis*. I have transferred it to the genus *Haliclona* (de Laubenfels, 1936, p. 40).

HALICLONA COERULESCENS (Topsent)

This species is represented in the collection by U.S.N.M. no. 22240, from the Atlantic coast of Panama, and also (less typically) by nos. 22250, 22219, and 22208, from the Pacific coast. The Panamanian specimens are basically encrusting, but cylindrical or lamellate processes commonly grow up from the base. The color is typically blue in life, but where in some ways interfered with by the environment it tends toward drab. The consistency is mediocre, and the surface is comparatively even, with no special dermal skeleton at all. The pores are about 200μ in diameter and occur about two to the square millimeter. The oscules vary from 1 to 2 mm in diameter and occur very irregularly. The indications are that where the current passing the sponge is insufficient, the more evident oscules occur. The endosome is an isodictyal reticulation of oxeas varying from 5μ by 120μ commonly to 6μ by 150μ and rarely to 9μ by 175μ .

This species was described as *Reniera coerulescens* by Topsent (1918, p. 537) from the West Indies. It is here transferred to the genus *Haliclona*. The Panama specimens do not differ to any significant extent from Topsent's specimens. This is one of the most characteristic species of the Canal Zone. It was found growing intertidally on rocks near Panama City, on wood beneath the piers at

Balboa Harbor, and intertidally on rocks at Taboga Island, all on the Pacific side. On the Atlantic side it was found growing intertidally on the coast at Fort Randolph, and one macerated specimen was found cast on the beach at Fort Sherman. The distinctive blue color and the ease with which a lamellate form is assumed are perhaps its most characteristic features.

Genus ADOCIA Gray

ADOCIA CINEREA (Grant)

The specimens thus identified are represented in the collection by U.S.N.M. no. 22242, collected intertidally at Fort Randolph at the Atlantic end of the canal, and no. 22210, from one of the piers in Balboa Harbor at the Pacific end. The characteristic color in life appears to be a beautiful lavender, but as in the case of *Haliclona permollis* environmental factors may alter this in the direction of drab. The consistency is crisply friable. The endosome is smooth and is provided with a special reticulation of spicules, which, however, are just like those of the endosome. They make a beautiful isodictyal pattern, the apertures of which, about 300μ in diameter, are to be interpreted as pores, 500μ apart, center to center. The oscules, which are 2 to 3 mm in diameter, are usually on slightly raised processes, but curiously enough are not always terminally placed. The endosome is an isodictyal reticulation of oxeads about 10μ by 150μ to 13μ by 200μ .

This is not the cosmopolitan sponge frequently referred to in the literature as *Reniera cinerea*, but it bears a superficial resemblance to it and may or may not have been confused with it by earlier authors. Too little attention has been paid to the precise characters of the dermis of sponges. Reinvestigation of museum specimens and further collection may prove that *Adocia cinerea* is as nearly cosmopolitan as is *Haliclona permollis*, the species frequently referred to as *Reniera cinerea*. Both were originally described from European waters, the former as *Spongia cinerea* by Grant (1827, p. 204). It was transferred to *Adocia* by Burton (1934, p. 535).

Genus TOXADOCIA de Laubenfels

TOXADOCIA PROXIMA (Lundbeck)

This amorphous sponge is represented in the collection by U.S.N.M. no. 22222. It was collected intertidally on the rocks at Taboga Island near the Pacific entrance to the Panama Canal. In life it was a pretty violet and very soft. The surface is even. There is an isodictyal special dermal skeleton, not, however, containing any special sort of spicules, nor is it readily detachable. The pores are barely visible to the naked eye and occur about two to the square millimeter. The oscules are two in number, about 1.5 mm in diam-

eter, and have about them raised collars over 2 mm high. The endosome is an isodictyal reticulation of oxeas about 6μ by 140μ , among which occur toxiform microscleres 2μ by 80μ .

This specimen differs in no significant respect from that Arctic species described as *Gellius proximus* by Lundbeck (1902, p. 70). It is noteworthy that several of the species occurring near Panama City, less than 10° from the Equator, should have as their closest relatives Arctic or Antarctic species.

ZETEKISPONGIA, new genus

Diagnosis.—Family Phorbasidae. Structure more reticulate than plumose; special diactinal ectosomal spicules associated with special diactinal endosomal ones of another sort; arcuate chelas and sigmas for microscleres.

Genotype.—*Zetekispongia zonca*, new species.

The generic name is given in respect to the eminent zoologist, Dr. James Zetek, of the United States Department of Agriculture, Balboa, Canal Zone.

ZETEKISPONGIA ZONEA, new species

FIGURE 40

Holotype.—U.S.N.M. no. 22215.

The species is also represented in the collection by U.S.N.M. no. 22223. It was found abundant intertidally on the rocks of Taboga Island, near the Pacific entrance to the Panama Canal. The color in life was a characteristic reddish orange, which fades little in preservatives; this is quite unusual. The consistency is soft, slightly spongy. The surface is coarsely tuberculate, with lumps about 1 mm high and several millimeters wide, but otherwise comparatively smooth. There is a conspicuous detachable dermal specialization composed of tangentially arranged spicules and underlain by extensive subdermal cavities. The rare oscules are approximately 1 mm in diameter, very unevenly distributed, and apparently missing from some specimens, which is doubtless correlated with the fact that the sponge grows where the waves sweep back and forth, creating almost constant strong currents. The endosome bears some resemblance to bread in structure; it is much like many specimens of *Myxilla* and *Lissodendoryx*. There is some tendency to an isodictyal reticulation, which is obscured by the fact that each side of each mesh is composed of many instead of only one spicule. There are occasionally vague tracts, of several rows of spicules, reaching a diameter of approximately 80μ . The special dermal spicules are tylotes, 4μ by 200μ to 5μ by 170μ . The endosomal spicules are oxeas 9μ by 210μ to 11μ by 215μ . There are two sizes of arcuate isochelas for microscleres, but neither is typically arcuate. The larger type, approximately 36μ long, some-

times verges toward the palmate. The smaller one varies from 16μ to 24μ long and has three teeth at each end, which are so sharply pointed that this might almost be called unguiferate. There are abundant sigmas 16μ to 24μ in length of chord, and a few small oxeote spicules about 2μ by 150μ , which are only dubiously to be regarded as microscleres inasmuch as there exists a possibility that they may be immature stages of the principal megascleres.

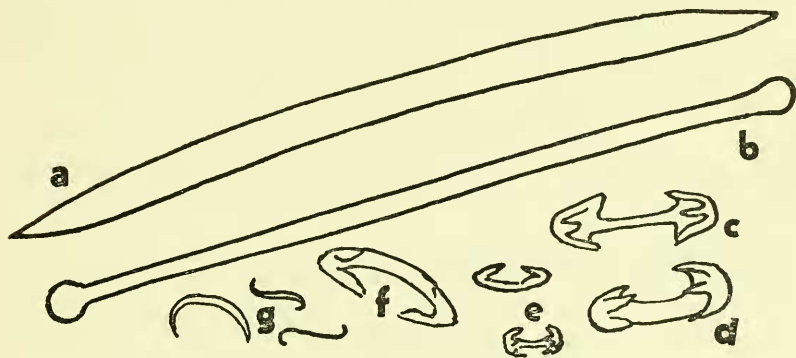


FIGURE 40.—*Zetekispongia zonea*, new genus and species: Spicules, $\times 666$ (camera lucida). *a*, Endosomal oxea; *b*, ectosomal tylote; *c*, larger arcuate chela; *d*, abnormal form of same; *e*, side and front views of the smaller chela; *f*, side view of larger chela; *g*, three views of the sigmas.

Were the principal spicules monactinal instead of diactinal, this would be a *Lissodendoryx*. This one point of difference in the megascleres, however, is here interpreted as being exceedingly important. In sponges of the family Axinellidae, the transition from monactinal to diactinal spicules is made very readily, but this species is unlike those of the family Axinellidae; instead it should be regarded as of the family Phorbasidae.

Genus MYCALE Gray

MYCALE CECILIA, new species

FIGURE 41

Holotype.—U.S.N.M. no. 22207.

This species is exceedingly abundant on the rocks in the intertidal zone at Panama City but apparently is not found in any other location yet studied. At least during July and August 1933, it was easily recognized by its striking color scheme. In life it was basically green, abundantly provided with bright red specks, which are almost certainly embryos. They are about 200μ in diameter but show plainly to the unaided eye from a considerable distance. The consistency is soft, the surface even. The oscules are about 2 cm apart, and their maximum size cannot be readily given. They are discovered in sponges

exposed by the retreating tide only because of being at the center of stellate figures made by radiating subdermal canals; otherwise they would be overlooked. They are closed (perhaps by sphinctrate action) practically to zero diameter. In the endosome there are plumose ascending tracts ending at the surface in brushes of spicules. An approximate diameter of about 100μ might be assigned to them. There is only one type of megasclere, a tylostyle varying from about 7μ by 300μ to 10μ by 300μ . The microscleres include palmate anisochelas of two size ranges, the larger about 22μ to 25μ , the smaller about 12μ to 15μ . In face view the alae of these anisochelas seem to be extraordinarily narrow, only about one-fifth of the length of the spicule. As a result of this, in special spicule preparations, they usually lie on the side. Among them are fairly numerous sigmas 30μ in length of chord.

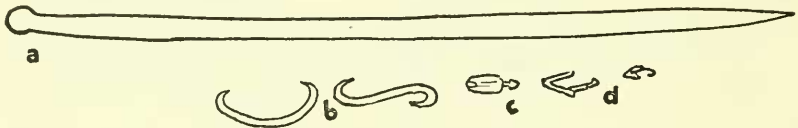


FIGURE 41.—*Mycale cecilia*, new species: Spicules, $\times 444$ (camera lucida). a, Megasclere (tylostyle); b, two views of the sigmas; c, front view of the anisochela; d, side views of the chelas, showing extremes in size (there are intermediates).

The common West Indian *Mycale*, which is *M. angulosa* (Duchassaing and Michelotti, 1864, p. 89) has peculiarly narrow anisochelas, but its megascleres are exceedingly thin, only 1μ to 4μ in diameter, in contrast to 7μ to 10μ in the Panama sponge. Furthermore, *M. angulosa* is a sponge that quickly grows up coarse and erect with hollow cylindrical form predominating; it is cavernous and reddish brown. *Mycale imperfecta* Baer (1905, p. 20) from the east coast of Africa also has relatively narrow anisochelas, but these are of only one sort, and its megascleres are small, only about 3μ by 200μ , whereas its sigmas are large, frequently reaching nearly 80μ in chord length, and 3μ in thickness. Probably the closest relative to *cecilia* is *Mycale phyllophila* Hentschel (1911, p. 294). Its megascleres did not attain the thickness of those in *cecilia*. It is represented only by thin specimens growing on leaves. Were larger and maturer specimens available, further points of difference from the Panamanian sponge might be expected to appear.

Genus MICROCIONA Bowerbank

MICROCIONA ATROSANGUINEA Bowerbank

This species is represented in the collection by U.S.N.M. no. 22204. It occurs rather commonly on the rocks in the intertidal zone at Panama City as a bright-red, thin encrustation. Some of the smooth

dermal tylostyles are as small as 1μ by 100μ . Some of the endosomal tylostyles reach the maximum size of 20μ by 670μ and are minutely spined on their heads. The echinating acanthostyles are 9μ by 90μ , the toxas 120μ long, and the palmate isochelas 12μ to 15μ .

This, the genotype of *Microciona*, was described by Bowerbank (1862, p. 1109) from Great Britain, and his description of European specimens might do well for this from Central America. There is no significant point of difference, and the identification is made confidently.

Genus HALICHONDRIA Fleming

HALICHONDRIA PANICEA (Pallas)

This cosmopolitan sponge is represented in the collection by U.S.N.M. no. 22202 from the Pacific coast and by no. 22232 from the Caribbean. It was found encrusting rocks intertidally at both ends of the Panama Canal, on the beach at Fort Randolph on the Atlantic end, and on the Pacific side both on the mainland at Panama City and also on Taboga Island, 10 kilometers offshore. It is a thin crust, pale orange in life, friable in consistency, with a smooth surface, readily detachable special dermal membrane containing tangential spicules, which are, however, like those in the endosome, namely, sharply pointed oxeads of great variation in size. They range commonly from 3μ by 180μ to 11μ by 270μ and sometimes even to 16μ by 930μ .

It may conceivably be that there are different species of sponges in various parts of the world all of which by convergent evolution happen to share the same characteristics in common, and all identified as *Halichondria panicea*, but since it is impossible to separate them sharply on any characteristics that may be recorded on paper, it is customary to identify them all with the long-known European form first described as *Spongia panicea* by Pallas (1766, p. 388).

Genus PSEUDOSUBERITES Topsent

PSEUDOSUBERITES SULCATUS (Thiele)

This species, represented in the collection by U.S.N.M. no. 22214, was found growing on submerged wood near the piers in Balboa Harbor at the Pacific end of the Panama Canal. In life it was dull drab and semitransparent. The consistency is very soft; the surface is even, provided with a detachable special membrane over extensive subdermal cavities. This ectosome contains spicules tangentially placed. There are surface openings about 140μ in diameter, but these are not sharply differentiated into oscules and pores. In the endosome the spicules are arranged in considerable confusion. They are tylostyles ranging from 4μ by 160μ to 6μ by 275μ .

This species was described as *Suberites sulcatus* by Thiele (1905, p. 417) from the extreme southern end of South America. Burton (1930, p. 334) also records it from the Antarctic and correctly transfers it to the genus *Pseudosuberites*. There is no considerable point of difference between the Panamanian specimen and those from the sub-Antarctic and Antarctic.

Genus LAXOSUBERITES Topsent

LAXOSUBERITES ZETEKI, new species

FIGURE 42

Holotype.—U.S.N.M. no. 22212, from Balboa, Canal Zone, on the Pacific coast; no. 22227 is a specimen from the Caribbean.

This is in some respects the species most characteristic of the Panama coast, being found abundantly at each end of the canal. The specimens are frequently large and massive, with digitate or hemispherical projections, often as much as or more than 8 cm high. The masses are frequently as large as a person's head. The color in life is fundamentally an ochre-yellow; an exceedingly thin layer at the surface, however, may be tinged with greenish or reddish color, or, as in the case of specimens from the Atlantic end of the canal, be almost completely covered with a brownish red. These colors may be due to the presence of algal cells on the surface. The consistency is weakly spongy or mediocre. The surface, aside from the above-mentioned digitate projections, is somewhat tuberculate but otherwise smooth and even, not at all hispid. The oscules are exceedingly contractile. In living specimens they can sometimes be made out, attaining a diameter of as much as 1 mm, but in preserved specimens they are often entirely or nearly invisible. A few exceptional individuals were found in which the oscules remained open, over 2 mm in diameter, and surrounded by a collar more than 2 mm high. These specimens grew where the currents were not very strong. This variation in oscular condition is a result of environmental stimuli and lacks taxonomical significance. The spicules in the ectosome are densely packed, erect, with points out, but do not differ significantly in size or shape from those in the endosome. The interior is minutely cavernous to dense, with occasional meandering canals about 2 mm in diameter. The flagellate chambers are subspherical, about 20μ to 25μ in diameter. About them the megascleres are strewn in confusion. No microscleres could be found, all the spicules being tylostyles varying from about 3μ to 20μ by at least 700μ in length, and how much more must remain problematical, inasmuch as the largest spicules were always found broken.

This species shows practically no trace of tendency to radiate form. Many specimens of *Laxosuberites* show a radiate form to a very slight extent but always under circumstances that lead to the suspicion that the radiate tendency had been present but then suppressed by environmental conditions. *L. zeteki* grows frequently where other sponges assume the radiate form, and it is difficult to see how its placement could interfere with that result. In contrast to this, the other sponges

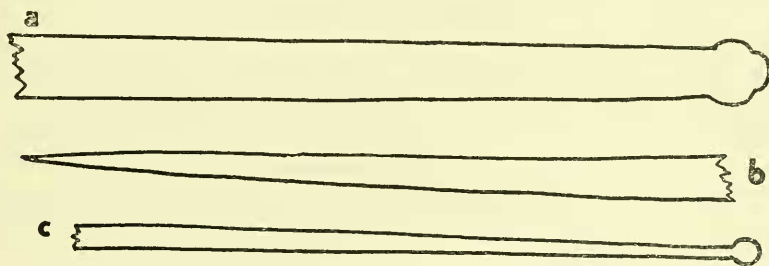


FIGURE 42.—*Laxosuberites zeteki*, new genus and species: Spicules, $\times 533$ (camera lucida). *a*, Head of larger tylostyle; *b*, pointed end of same, middle portion not shown; *c*, head of smaller (immature) tylostyle.

in its immediate vicinity are practically never ramose. Its intertidal placement is not conducive to its habitus; instead the vigorous action of the waves would tend to compel most sponges to assume a merely encrusting form. In spite of this *zeteki* grows up massive with projections, occasionally almost ramose. For this reason there cannot be assigned any close relatives to it, and it is even questionable whether it should be left in the genus *Laxosuberites* or given another genus of its own. It is a very distinctively marked species.

The specific name is given in honor of Dr. James Zetek, of the United States Department of Agriculture, Balboa, Canal Zone.

Genus TETHYA Lamarck

TETHYA DIPLODERMA Schmidt

This subspherical sponge is represented in the collection by U.S.N.M. no. 22203. The color in life was yellow, the consistency cartilaginous. There is a cortex about 800μ thick grown into low tubercles about 500μ high and the same distance apart, apex to apex. It is hispid, with spicules projecting nearly a millimeter. The endosome is radiate, with ascending tracts of spicules about 200μ thick. The megascleres themselves are tylostyles, about 11μ by 900μ to 14μ by $1,200\mu$. The larger spherasters occur not at the immediate surface but in the deeper layer of the cortex, and rarely in the endosome, and are about 67μ in diameter. The smaller asters occur in the extreme outer cortex and abundantly throughout the

endosome. They are of two sorts, tylasters about 10μ in total diameter, and oxyspherasters only about 7μ in diameter.

This species was first described by Schmidt (1870, p. 52) from the West Indies and has since been recorded from the west coast of Mexico, the east coast of South America, both east and west coasts of Africa, the Indian Ocean, East Indies, and New Zealand. The Panamanian specimens are quite typical of the race as found around the world.

TABOGA, new genus

Diagnosis.—Family Tethyidae. The radiate, corticate structure resembles *Tethya*, but with very pronounced development of root structures. The strongyle-oxeote megascleres also resemble those of *Tethya*. The microscleres include spherasters somewhat like those of *Tethya*, but in addition there are typically three other distinct categories of asters, one of which is peculiar for sharply branched terminations to its rays.

Genotype.—*Taboga taboga*, new species.

TABOGA TABOGA, new species

FIGURE 43

Holotype.—U.S.N.M. no. 22216.

This species is moderately abundant intertidally on Taboga Island at the Pacific end of the entrance to the Panama Canal; it was not found elsewhere. The shape is subspherical, up to slightly over 2 cm in diameter, but most of the specimens are only about 1 cm in diameter. Each is attached to the substratum by ribbon-shaped roots, only 0.1 to 0.2 mm thick but usually 2 mm wide. There are ordinarily 5 to 15 such roots extending from each sponge and reaching out in some cases as much as 1 cm or more, anchoring the mass very firmly so that it may be held in place in spite of vigorous wave action. In life the surface is covered with a dull red layer 1 mm deep. This consists of a spicule plush of megascleres standing erect, rarely embedded in the white surface below them, and interspersed with rather loosely placed reddish cells that may or may not be proper to the sponge. The regularity with which they occur and the uniformity of their color suggest, however, that they are proper.

Below this red layer is a white layer of equal thickness. Its structure is corticate to cartilaginous. It represents the most extreme development of contractile tissue in any sponge known to me. Below the red-and-white layers the endosome is ochre-yellow and permeated by transparent fascicular columns packed with spicules radiating from the central point of the sponge to the surface. Above them the surface is thrown into tuberculous protrusions not quite 1 mm in

diameter. The oscules and pores are each minute and not readily made out. The root-like structures mentioned above are rendered shaggy, being densely packed with spicules, and contain practically no cavernous structures. The megascleres are spindle-shaped strongyles, or strongyloxeas, commonly 13μ by 600μ , occasionally slightly inequidended. Some, in fact, are almost styles. Spherasters with very sharply pointed rays, total diameter about 65μ , occur abundantly in the whitish ectosomal layer and to a certain extent also in the endosome. Both in the cortex and in the endosome occur also a few asters with conspicuously hastate pointed ends to the rays, total diameter 60μ , and comparatively abundant others, similar but

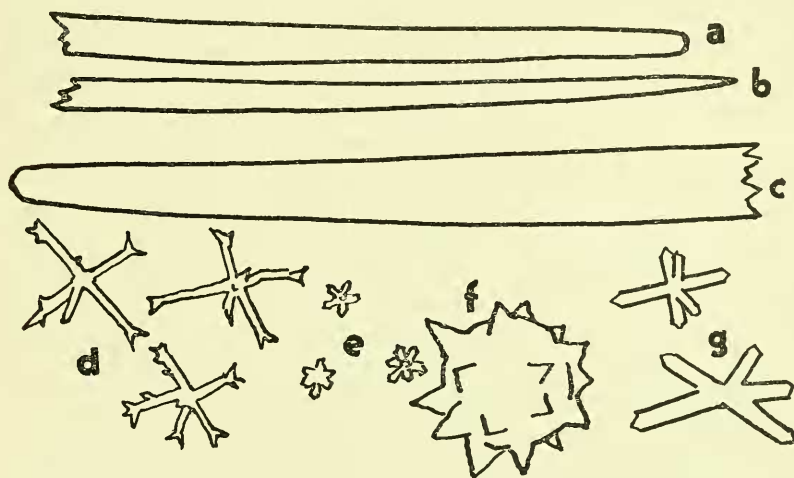


FIGURE 43.—*Taboga taboga*, new genus and species: Spicules, $\times 666$ (camera lucida). a, Common termination (of end toward ectosome) of the megasclere; b, as above, but a less common sort; c, termination (away from ectosome) of the megasclere; d, three views of the most distinctive sort of aster; e, three views of the most common sort of aster; f, ectosomal spheraster; g, two views of the (uncommon) larger hastate rayed asters.

with very short rays, diameter 12μ . In the endosome occur only long-rayed euasters (perhaps provided with a minute centrum), total diameter 36μ to 60μ , the rays occasionally dichotomously or trichotomously branched at the end, and provided with a very few spines laterally placed on them.

One of the most remarkable characteristics of this unusual sponge is the strength of its muscular(?) tissue. When a living specimen is cut into deeply the cortex contracts so strongly that the endosome is forced to protrude from the wound. The collector with his fingers was unable to restrain this contraction and gives it as his opinion that the force was greater than that of the muscles that bend the fingers of a person with ordinary strength.

Genus **PLACOSPONGIA** Gray**PLACOSPONGIA INTERMEDIA** Sollas

This species is represented in the collection by U.S.N.M. no. 22201, from the Pacific side, and no. 22233, from the Atlantic side of the Canal Zone. It is moderately common at each end of the canal, forming encrustations about 1 mm thick on coral or rock. The color in life is orange-ochre, changing to brown or drab in places where it seems to have been adversely affected by the environment. The consistency is friable, hard. The surface is given over to conspicuous polygonal plates separated by cracks only about 100μ wide. These plates are about 150μ to 350μ thick, and seem to be imperforate. The inhalent and exhalent apertures are presumably in the cracks between them. The endosomal structures are chiefly in confusion, but a few vague tracts about 100μ in diameter may be made out. The megascleres are exclusively tylostyles, of which, however, the heads are sometimes so small as to be barely larger than the shaft. These vary in size from about 6μ by 250μ to 8μ by 400μ . The dermal cortex is densely packed with sterrasters 20μ by 35μ to 35μ by 50μ . Among the other microscleres are small spheres about 8μ in diameter, covered by minute spines; these are young forms of the sterrasters, as shown by the existence of forms intermediate between them. These occur chiefly in the endosome, as do the abundant spirasters 1μ by 4μ to 2μ by 8μ . There are also short spirasters or plesiasters with very long spines with a tylote to strongylote modification at the end of each. These range from about 14μ by 18μ to 15μ by 20μ .

Placospongia intermedia was described by Sollas (1888, p. 272) from Punta Arenas, Central America. There is a large port by this name on the Pacific coast of Costa Rica, presumably the locality referred to. It appears to be a form characteristic of this portion of the world. There is no significant difference between the specimen found on the Pacific side of Panama and those found at the Atlantic side.

Genus **GEODIA** Lamarck**GEODIA GIBBEROSA** Lamarck

This massive species is represented in the collection by U.S.N.M. no. 22217, from the Pacific side, and no. 22231, from the Atlantic side of Panama. It is gray-white, cartilaginous in consistency, and has a surface hispid in places only. The pores are very conspicuous, about 1 mm apart and 0.3 mm in diameter. The oscules are equally conspicuous, circular, in depressed areas, and are about 1 to 3 mm in diameter. There is a cortex 0.5 to 1 mm thick, which is densely packed with spherasters about 60μ by 75μ . The endosome is strongly radiate with principally large oxcas, about 27μ by 800μ or larger, and plagio-

triaenes with rhabds about 30μ by $3,000\mu$. Among the microscleres, in addition to the sterrasters, there are euasters 10μ to 15μ in diameter and very small spherasters, mostly centrum, the entire spicule only about 3μ in diameter.

The last-mentioned type of microsclere is one of the most characteristic features of *Geodia gibberosa*, which was described by Lamarek (1815, p. 334) from the West Indian region, of which it is very characteristic.

Genus OSCARELLA Vosmaer

OSCARELLA LOBULARIS (Schmidt)

This species is represented in the collection by U.S.N.M. no. 22206. It was found growing (as usual) as a thin encrustation on rocks in the intertidal zone at Panama City on the Pacific side of the isthmus. In life it is transparent and drab, consistency mediocre, surface smooth and even. The oscules and pores were not optically evident. The flagellate chambers are spherical, 25μ in diameter.

This aspiculous, askeletal, interesting species is probably cosmopolitan, although nowhere abundant. It was first described as *Halisarca lobularis* by Schmidt (1862, p. 80). It is difficult to find any basis for separating those Oscarellas found in other parts of the world from the original European species with which they may indeed be genuinely conspecific. The Panama specimens are quite typical.

DESCRIPTION OF ATLANTIC COAST SPECIES

The six species found also at the Pacific end of the Panama Canal—*Haliclona coerulescens*, *Adocia cinerea*, *Halichondria panicea*, *Laxosuberites zeteki*, *Placospongia intermedia*, and *Geodia gibberosa*—are not repeated here.

Genus SPONGIA Linnaeus

SPONGIA BARBARA Duchassaing and Michelotti

This species is represented in the collection by U.S.N.M. no. 22230. It is a subspherical mass, black exteriorly and dull ochre in the endosome. The consistency is exceedingly spongy. The surface conules are not quite 1 mm high and about 1 mm apart. The oscules, about 3 mm in diameter, are raised, with slight collars about them. The flagellate chambers are spherical, about 20μ in diameter. The common fiber that makes up the customary dense reticulation is 30μ in diameter. The general structure is that of the common sponge of commerce, known as the "yellow."

Hyatt (1877, p. 515) records what he calls *Spongia lignea* from Pearl Island, Panama Bay. This is inadequately described because of the poor condition of Hyatt's material.

While in Panama I met an elderly Greek gentleman named Kefalos who claimed to have been a sponge fisherman in his younger days and to have collected and sold commercial sponges from the vicinity of Panama on both coasts, though more commonly from the Atlantic side. On the Pacific side I met a professional shark fisherman who claimed to have seen a few commercial sponges, although none could be found at that time. The evidence would appear to show that there was little economic importance to be attached to sponge fisheries from this immediate neighborhood, as commercial sponges do not exist in great enough abundance.

This species was collected on the coast at Fort Randolph on the Atlantic Coast of Panama near the north end of the Canal.

Genus TRYPESPONGIA de Laubenfels

TRYPESPONGIA COLUMBIA de Laubenfels

This species is represented in the collection by U.S.N.M. no. 22243. It was collected on the coast at the Atlantic side of the Canal Zone at Fort Randolph. In shape it is an amorphous mass. It was drab in life. Its consistency is exceedingly spongy. The surface conules are less than 1 mm high and are 1 mm apart, more or less. The abundant oscules are about 1 mm in diameter and are scattered in irregular groups. In the groups they are only 2 or 3 mm apart, but the groups themselves are 2 or 3 cm apart. The interior is strongly reticulate, with ascending fiber reaching 65μ in diameter, containing some foreign material in addition to the spongin. The more abundant secondary fibers are about 25μ in diameter and contain no foreign material. There is some detritus, especially broken foreign spicules, scattered loosely in the flesh. The histological structure of this species is very remarkable. The protoplasmic portions are arranged in thin sheets, only about 25μ to 35μ thick, which are arranged haphazard without any very definite pattern but crowded fairly close together. Those structures, which correspond obviously to flagellate chambers in ordinary sponges, are little more than apertures or oval holes through these sheets, 30μ to 40μ in diameter.

It is not known whether the species is important commercially. It was described from the West Indies by deLaubenfels (1936, p. 13).

Genus HIRCINIA Nardo

HIRCINIA CAMPANA (Lamarck)

This species is represented in the collection by U.S.N.M. no. 22248. It grows abundantly in shallow water near Fort Sherman at the Atlantic end of the Panama Canal. The typical shape is a vase-like form, frequently 20 cm high. The color in life is reddish brown, the consistency tough and spongy. It is coarsely conulose, with the conules 1 mm high and about 3 mm apart. The abundant oscules

are located chiefly or entirely on the interior of the vase. The principal spongin tracts are fascicular and coarse, and among them are many filaments of a substance resembling, but perhaps not the same as, spongin, about 4μ thick, with swollen heads 5μ or 6μ thick at each end, the total length being frequently more than 1 mm.

This species was described as *Spongia campana* by Lamarek (1814, p. 385) from the West Indies, where it is one of the most abundant and typical sponges.

HIRCINIA VARIABILIS (Schmidt)

This species is represented in the collection by U.S.N.M. no. 22249. It grows abundantly in shallow water near Fort Sherman at the Atlantic end of the Panama Canal. The shape is amorphous to encrusting, with digitate processes occasionally rising from the main mass. The color in life is greenish brown, and the consistency is tough and spongy. The conules are small, only about 0.5 mm high and 1 to 2 mm apart. The oscules are exceedingly conspicuous, not only because they have collars raised about them, but because the tissues immediately within them are very dark. The fascicular tracts and filaments are very much like those in the preceding species.

This may not be exactly the same species as that first described as *Filifera variabilis* by Schmidt (1862, p. 34), a Mediterranean form, but it does not seem appropriate to establish a new name for it at the present time. The form occurring at Panama is exceedingly abundant throughout the entire West Indian region.

Genus HALICLONA Grant

HALICLONA ERINA, new species

Holotype.—U.S.N.M. no. 22245.

This species was found growing intertidally on the Atlantic coast of Panama at Fort Randolph. The shape is amorphous to encrusting. The color in life was a brilliant green. The consistency is mediocre, with a notable lack of any special dermal skeleton, a lack entirely typical of the genus *Haliclona*. The endosome in places shows an isodictyal reticulation, and elsewhere there are vague ascending tracts about six spicule rows thick, or even as much as 50μ thick. The flagellate chambers are spherical, about 30μ in diameter. The only type of spicule present is a sharp-pointed oxea, but the variation in size is greater than is customary in the genus *Haliclona*, somewhat like that of *Halichondria*. The spicules range from as small as 3μ by 120μ to as large as 10μ by 200μ . Because of the surface structure, however, the identification is made with *Haliclona*, within which genus, in addition to various minute differences, the bright green

color is distinctive. It must be admitted that this may be a remarkable modification of some previously described *Haliclona*, due perhaps to unusual environmental conditions, but it is impossible to say which *Haliclona* has been so modified. It is not certain that this is the real situation, and it seems preferable to give a definite name by which the species may be referred to rather than merely to call it *Haliclona* "species indeterminate."

HALICLONA DORIA, new species

Holotype.—U.S.N.M. no. 22228.

One very large specimen was found growing in shallow water on the shores near Fort Randolph. It was a ramose bush, in life reaching a height of nearly 1 meter, with perhaps as many as 100 branches. Each of the branches is circular in cross section and a little over 1 cm in diameter. The color in life was mahogany-brown. The consistency in life was slightly flexible, very stiff. It is rather fragile as preserved in alcohol. To the naked eye the surface is even, although microscopically rough. The abundant pores are about 100μ to 200μ in diameter. The oscules are 2 to 3 mm in diameter and may or may not be provided with an oscular collar about them. They are very irregularly distributed, often in rows along one side only of a cylindrical branch. In the row they are only about 1 cm apart. The internal structures are very compact, the fibers crossing each other in reticulation almost at right angles, all of them, both ascending and transverse, being approximately the same size, varying between 20μ and 50μ . The ground substance about the fibers is subsodictyal. Only one type of spicule is present, an oxea 9μ by 170μ .

At and near the point of collection there were practically no other sponges even approaching the ramose form. It was a beach where the waves regularly broke with considerable force, and there was clear-cut evidence that the environment was not very favorable to this habitus. It is true that there was a depression in the immediate vicinity of this specimen, but not enough to have prevented all buffeting by waves. The conclusion, therefore, is that this species shows an unusually strong tendency toward the ramose form. This, together with the somewhat unusual color, is rather distinctive within *Haliclona*, large as that genus is. Perhaps the species nearest to the one under consideration is that described as *Thalysias subtriangularis* Duchassaing and Michelotti (1864, p. 85). Compared to that, *doria* has larger spicules, a different color, and the branches terminate in sharp points instead of blunt clublike shapes. This is about all that can be said definitely, but to the person who handles the two species in life, as I did, the general impressions and feeling are so strikingly different that there is no suggestion that the two are the same.

Genus **STRONGYLOPHORA** Dendy**STRONGYLOPHORA SANTA**, new species

Holotype.—U.S.N.M. no. 22244.

This species is found growing intertidally on the shore near Fort Randolph. The shape is amorphous, the color in life greenish black, and the consistency between friable and stony. There is a distinct special dermal structure present, overlying extensive subdermal cavities. The surface is comparatively smooth and even. There are very few oscules, about 1 mm in diameter, not provided with collars about them. The internal structure is subsodictyal, somewhat resembling "crumb-of-bread." There is an astonishingly large variation in the size of the flagellate chambers. They are subspherical and range from only 18μ up to as much as 36μ in diameter. Throughout the basal reticulation there is another one of fibers containing much spongin and only a few rows of spicules, say three or four. This fiber is about 40μ in diameter. The spicules are of two sorts. The most abundant kind is a strongyle usually 17μ by 250μ , but varying from at least as small as 12μ by 240μ to as large as 18μ by 270μ . The second sort of spicule is an oxea 5μ by 215μ in ordinary size.

The genotype of the genus *Strongylophora* is *durissima*, described by Dendy (1905, p. 141) from Ceylon. It is much like the Panamanian sponge here described, except for paler color, crumpled external shape, and much smaller microxea, which were very thin and only 28μ long. The same general comparison may be made to all the other species customarily referred to the genus *Strongylophora*; i. e., their microscleres are a great deal smaller than those in *santa*. They are all probably rather closely related to one another.

Genus **TEDANIA** Gray**TEDANIA IGNIS** (Duchassaing and Michelotti)

This species is represented in the collection by U.S.N.M. no. 22247. It grows abundantly in shallow water in the vicinity of Fort Sherman, the masses being frequently about the size of a man's fist. The color in life is a brilliant red. The consistency is mediocre to spongy. The surface is even, over low, wide tuberculate structures. There is a definite special dermal membrane overlying extensive subdermal cavities. The oscules are about 5 mm in diameter and frequently have oscular collars about them as much as 5 mm high or even more. The general structure is somewhat cavernous. The special dermal spicules are tylotes 4μ by 230μ . The endosomal spicules are styles 9μ by 300μ , and the microscleres are the so-called onychaetes, roughened rhapides, about 2μ by 110μ .

This species was first described as *Thalysias ignis* by Duchassaing and Michelotti (1864, p. 83). It is one of the most abundant and

characteristic of all West Indian sponges. As to whether it is conspecific with other species in the genus *Tedania* found in other parts of the world there is considerable room for argument.

FISHERISPONGIA, new genus

Diagnosis.—Family Ophlitaspongiidae. A genus with two distinct categories of megascleres, a dermal tylostyle and an endosomal plain style, associated with toxas and palmate isochelas. Diagnostic reference may or may not be added as to the quantity of sand present. The dense, almost radiate, structure, however, is not typical of the family Ophlitaspongiidae but verges strongly toward that of the order Haplosclerina. The genus that should be most closely compared here is *Camptisocale* Topsent (1927, p. 7) described from the Azores. It has significantly similar structure and has the polytylote dermal spicules over styles as principal megascleres. Its only microscleres, however, are odd-shaped palmate anisochelas. A second similar genus is

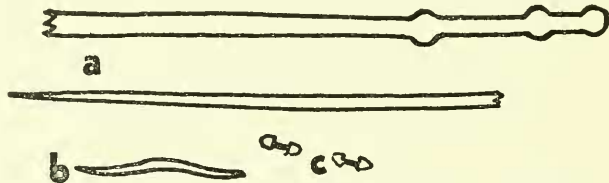


FIGURE 44.—*Fisherispongia ferrea*, new genus and species: Spicules, $\times 666$ (camera lucida). *a*, Terminations of the megasclere sort (polytylote style) mid portion not shown; *b*, toxa; *c*, two views of the isochelas.

Phelloderma, described by Ridley and Dendy (1887, p. 85) from the South Atlantic. This also has the polytylote spicules together with plain styles, and palmate isochelas, but these are of remarkable shape, being almost the sort known as a placochelela.

Genotype.—*Fisherispongia ferrea*, new species.

The generic name is given in respect to the eminent zoologist, Prof. W. K. Fisher, of Stanford University, California.

FISHERISPONGIA FERREA, new species

FIGURE 44

Holotype.—U.S.N.M. no. 22239.

This species is found growing intertidally at Fort Randolph. The shape is amorphous, and the color in life is bright red. The consistency is obscured by the fact that it is full of foreign materials and sand. The surface is between tuberculate and even, and the pores and oscules are not readily made out. There is a conspicuous layer of spicules with their heads on the substratum, standing erect with

respect to it, and from them semiplumose bushes of spicular tracts arise toward the surface, where they form tufts. The spicules at the surface are considerably smaller than those farther down and are polytylote tylostyles; i. e., they not only have the tylote swelling at the blunt end, but several similar swellings interposed here and there along the length of the spicule. Their size is about 2μ by 250μ . The endosomal spicules are smooth styles about 9μ by 500μ or 600μ . There are two sorts of microscleres, each very abundant. One sort is a toxa about 35μ long, and the other a palmate isochela only 10μ long.

Genus CLIONA Grant

CLIONA CARIBBOEA Carter

This species is represented in the collection by U.S.N.M. no. 22241. It occurs boring into calcareous material (frequently dead coral) on the beach at Fort Randolph and perhaps at other places in the Canal Zone. Its color in life is yellow, and the consistency is cartilaginous. The external structures are papillate bits of flesh that protrude here and there from the calcareous material and that reach a size of slightly over 1 mm in diameter and height. The apertures are slightly under 1 mm in diameter when fully opened, and they are found apically situated on the papilles. Only one type of spicule was found in the Panamanian specimens. This is a tylostyle about 14μ by 350μ .

This species was described by Carter (1882, p. 346) from the West Indies, of which it may be said to be very characteristic, unless it should be decided that it is conspecific with the cosmopolitan species *Cliona celata* Grant, to which it bears considerable resemblance.

Genus SPIRASTRELLA Schmidt

SPIRASTRELLA CUNCTATRIX Schmidt

The specimen thus tentatively identified is represented in this collection by U.S.N.M. no. 22226. It is a thin crust collected intertidally at Fort Randolph. It was bright orange in life and cartilaginous in consistency. The surface is even, and the spicules consist exclusively of tylostyles varying in size from 7μ by 250μ to 11μ by 415μ , associated with spirasters. These are at the most only 15μ by 20μ , and many are much smaller than this.

S. cunctatrix was described by Schmidt (1868, p. 17). The present specimen differs in many minor ways from the Mediterranean kind, but it is not now deemed advisable on the basis of the quantity of material present and in view of the slight differences, to establish for it a new species.

Genus TETHYA Lamarck**TETHYA AURANTIA (Pallas)**

This species is represented in the collection by U.S.N.M. no. 22234. It occurs intertidally at Fort Randolph. It is spherical in shape and was bright orange-yellow in life. The consistency is cartilaginous, and the surface is coarsely tuberculate, with rounded tubercles crowded closely together, each about 2 mm in diameter and height. The megascleres are strongyloxeas about 25μ by 2500μ . The microscleres include large spherasters about 55μ in diameter and small spherasters only about 9μ in diameter.

This cosmopolitan species was described by Pallas (1766, p. 357) as *Alcyonium aurantium*. The Panamanian specimens do not differ in any significant respect from the numerous ones found in all parts of the world.

Genus CINACHYRA Sollas**CINACHYRA APION Uliczka**

This species is represented in the collection by U.S.N.M. no. 22229. The one specimen was collected intertidally at Fort Randolph. It was yellow in life. Its consistency is between cartilaginous and mediocre. It is exceedingly hispid with a spicule plush 2 mm high or more over the entire surface. The abundant openings, representing probably both inhalent and exhalent structures, are cavities 1 to 3 mm in diameter, rounded at the bottom of the concavity, and so abundant that in many places they are only 3 mm apart. The internal structure is strongly radiate, including numerous oxeas, about 30μ by 3 mm long, and protriaenes and anatriaenes having rhabds of about the same size range as the oxeas. The clads of these spicules diverge very widely, almost at right angles to the main shaft, so that they do not differ greatly from orthotriaenes. The microscleres are small sigmoid spicules 10μ in length of chord.

This species was described by Uliczka (1929, p. 43) from the West Indies, to which locality it appears to be restricted.

PLAKOOSA, new genus

Diagnosis.—Family Halinidae. A genus having as spicules two size ranges of very small, much modified tetraxon spicules, the smaller of which resemble asters.

Relationship is indicated to *Plakortis* Schulze, which does not have the latter type of spicule, to *Halina* Bowerbank in which the second type is an obvious streptaster, and closest of all to a common West Indian sponge, *Roosa zyggompha* deLaubenfels (1934, p. 2), which has somewhat similar megascleres, but not the microscleres.

PLAKOOSA ELISA, new species

FIGURE 45

Holotype.—U.S.N.M. no. 22237.

The one specimen of this interesting species was collected intertidally at Fort Randolph. It is an encrustation considerably less than 1 mm thick and about 2 by 4 cm in lateral area. The color in life was blue; the consistency is mediocre. The surface is minutely punctiform. The depressions here referred to are perhaps to be interpreted as the location of pores. The entire surface is thickly set with apertures about 200μ in diameter, one or more to the square millimeter; which of these are exhalent and which inhalent cannot readily be made out. The internal structure is densely fleshy, except for the flagellate chambers, which are spherical, approximately 55μ in diameter. About them the spicules are densely crowded. Those that are possibly to be interpreted as megascleres are not much larger than microscleres. They are commonly siliceous triaxons, with each ray approximately 2μ by 25μ . Some of them

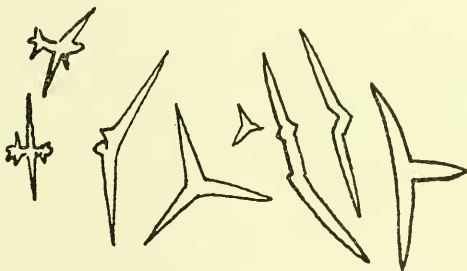


FIGURE 45.—*Plakoosa elisa*, new genus and species: Spicules, $\times 666$ (camera lucida). Only relatively abundant sorts are shown.

may be described as sagittal with a very short rhabd or as a bent oxea with a spine at the middle. Others have two spines at the middle, as if they were reduced tetraxons. Still others are like oxeas, with a bend in the middle that doubtless represents the place where a hypothetical third or even fourth ray may have been placed. All the megascleres may plausibly be interpreted as reduced tetraxons. The microscleres bear a faint resemblance to asters, but although they show much variation in shape, the following type is common: There is an oxote central shaft about 12μ long, from the middle of which protrude one or more branches about 4μ or 5μ long, each of which in turn has one or two branches only 1μ or 2μ long. Each ray is 1μ or less in diameter. These might be further named, by using the prefixes that are both applicable and customary, "micromesoorthotrichotriaenes."

Genus CHONDRILLA Schmidt**CHONDRILLA NUCULA Schmidt**

This species is represented in the collection by U.S.N.M. no. 22235. It is found growing on the coast near Fort Randolph. The shape is amorphous to rounded, the color in life sepia-brown, and the consistency cartilaginous. The surface is even, and resembles rubber. The internal structures are densely colloidal, with fairly abundant spherical flagellate chambers about 20μ in diameter. The only type of spicule present is a spheraster about 30μ in diameter.

This species was described by Schmidt (1862, p. 39). It is found not only in the Mediterranean and in Australia, but abundantly in the West Indies.

LITERATURE CITED

BAER, LEOPOLD.

1905. Silicospongien von Sansibar, Kapstadt und Papeete. *Arch. Naturg.*, vol. 72, pp. 1-32, 5 pls.

BIDDER, GEORGE PARKER.

1923. The relation of the form of a sponge to its currents. *Quart. Journ. Micr. Sci.*, new ser., vol. 67, pp. 293-323, 12 figs.

BOWERBANK, JAMES SCOTT.

1862. On the anatomy and physiology of the Spongiadae. *Phil. Trans. Roy. Soc. London*, vol. 152, pp. 747-829, 1,087-1,135, pls. 27-35, 72-74.

1866. A monograph of the British Spongiadae, vol. 2, 388 pp. London.

BURTON, MAURICE.

1928. A comparative study of the characteristics of shallow-water and deep-sea sponges, with notes on their external form and reproduction. *Journ. Quekett Micr. Club*, ser. 2, vol. 16, pp. 49-70, 7 figs., 1 pl.

1930. Report on a collection of sponges from South Georgia and from Campbell Island, South Pacific, obtained by Dr. Kohl-Larsen. *Senckenbergiana*, vol. 12, pp. 331-335, 1 fig.

1934. Sponges. British Museum (Natural History) Great Barrier Reef Expedition, 1928-29, Scientific Reports, vol. 4, no. 14, pp. 513-622, 33 figs., 2 pls.

CARTER, HENRY JOHN.

1882. Some sponges from the West Indies and Acapulco in the Liverpool Free Museum described, with general and classificatory remarks. *Ann. Mag. Nat. Hist.*, ser. 5, vol. 9, pp. 266-301, 346-348, 2 pls.

DENDY, ARTHUR.

1905. Report on the sponges collected by Professor Herdman, at Ceylon, in 1902. *In Herdman, Rep. Pearl Oyster Fisheries*, suppl. 18, pp. 57-246, 16 pls.

DUCHASSAING DE FONBRESSIN, PLACIDE, and MICHELOTTI, GIOVANNI.

1864. Spongiaires de la mer Caraïbe. *Nat. Verh. Mij. Haarlem*, vol. 21, pp. 1-124, 25 pls.

DYBOWSKY, WLADISLAV.

1880. Studien über die Spongien des russischen Reiches, mit besonderer Berücksichtigung der Spongien-Fauna des Baikal-Sees. *Mém. Acad. St. Pétersbourg*, ser. 7, vol. 27, 71 pp., 4 pls.

GRANT, ROBERT EDMOND.

1827. Notice of two new species of British sponges. *Edinburgh New Philos. Journ.*, vol. 2 (1826?) pp. 203-204.

HENTSCHEL, ERNST.

1911. Tetraxonida, Teil 2. *In Michaelson and Hartmeyer, Fauna Südwest-Australiens*, vol. 3, pp. 279-393, 54 figs.

HYATT, ALPHAEUS.

1877. Revision of the North American Poriferae; with remarks upon foreign species, pt. 2. *Mem. Boston Soc. Nat. Hist.*, vol. 2, pp. 481-554, 3 pls.

LAMARCK, JEAN BAPTISTE PIERRE DE MONET DE.

- 1813-14. Sur les polypiers empâtés. *Ann. Mus.*, vol. 20, pp. 294-312, 370-386, 432-458.

1815. Suite des polypiers empâtés (dont l'exposition commence au 20^e volume des Annales, p. 294). *Mém. Mus.*, vol. 1, pp. 69-80, 162-168, 331-340.

LAUBENFELS, MAX WALKER DE.

1932. The marine and fresh-water sponges of California. Proc. U. S. Nat. Mus., vol. 81, art. 4, 140 pp., 79 figs.
1934. New sponges from the Puerto Rican Deep. Smithsonian Misc. Coll., vol. 91, no. 17, 28 pp.
1936. A discussion of the sponge fauna of the Dry Tortugas in particular and the West Indies in general, with material for a revision of the families and orders of the Porifera. Carnegie Inst. Washington Publ. 467 (Pap. Tortugas Lab., vol. 30), 225 pp., 1 map, 22 pls.

LENDENFELD, ROBERT VON.

1889. A monograph of the horny sponges, 936 pp., 50 pls. London.

LUNDBECK, WILLIAM.

1902. Porifera. The Danish *Ingolf*-Expedition, vol. 6, pt. 1, 108 pp., 1 fig., 1 map, 19 pls.

MEREJKOWSKY, CONSTANTINE DE.

1878. Predvaritelny otezet o bjelomorskich gubkach (Preliminary account of sponges of the White Sea). Trudi St. Petersburg Obshek. Estestvo., vol. 9, pp. 249-269.

PALLAS, PETER SIMON.

1766. Elenchus zoophytorum, 451 pp.

RIDLEY, STUART OLIVER, and DENDY, ARTHUR.

1887. Report on the Monaxonida collected by H. M. S. *Challenger* during the years 1873-76. Rep. Sci. Res. *Challenger*, Zool., vol. 20, pt. 59, 275 pp., 1 map, 51 pls.

SCHMIDT, (EDUARD) OSCAR.

1862. Die Spongien des adriatischen Meeres, 88 pp., 7 pls. Leipzig.
1868. Die Spongien der Küste von Algier. Mit Nachträgen zu den Spongien des adriatischen Meeres. (Drittes Supplement), 44 pp., 5 pls. Leipzig.
1870. Grundzüge einer Spongien-Fauna des atlantischen Gebietes, 88 pp., 6 pls. Leipzig.

SOLLAS, WILLIAM JOHNSON.

1888. Report on the Tetractinellida collected by H. M. S. *Challenger* during the years 1873-1876. Rep. Sci. Res. *Challenger*, Zool., vol. 25, 458 pp., 1 map, 44 pls.

THIELE, JOHANNES.

1905. Die Kiesel- und Hornschwämme der Sammlung Plate. Zool. Jahrb. Suppl. 6, pp. 47-496, 7 pls.

TOPSENT, ÉMILE.

1918. Éponges de San Thomé. Essai sur les genres *Spirastrella*, *Donatia* et *Chondrilla*. Arch. Zool. Exp., vol. 57, pp. 535-618, 29 figs.
1927. Diagnoses d'éponges nouvelles recueillies par le Prince Albert I^{er} de Monaco. Bull. Inst. Océanogr. Monaco, no. 502, 19 pp.

ULICZKA, EMIL.

1929. Die tetraxonen Schwämme Westindiens. Zool. Jahrb. Suppl. 16, Heft 1, pp. 35-62, 76 figs., 1 pl.



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 83

Washington: 1936

No. 2994

NEW SPECIES OF POLYCHAETOUS ANNELIDS OF THE
FAMILY NEREIDAE FROM CALIFORNIA

By OLGA HARTMAN

University of California, Berkeley, Calif.

ANNELIDS of the family Nereidae from many sources have been used in this study. Collections that were made by many persons over many years and that have accumulated in the department of zoology of the University of California at Berkeley were especially valuable. My own collecting was very extensive for Moss Beach, San Mateo County, and less complete for other parts of California, including points between Mendocino County and Los Angeles County. In addition, several smaller recent collections furnished a few interesting species. Such are the collection made at Dillon Beach, Marin County, by Prof. O. L. Williams, of the College of the Pacific at Stockton; one made at Pacific Grove, Monterey County, by Dr. R. M. Eakin; and one made off southwestern Oregon by Prof. C. R. Monk, of Willamette University. Holotypes are deposited in the United States National Museum; paratypes of all except *Nereis* (*Eunereis*) *longipes*, known only from the unique holotype, are in the California Academy of Sciences and the University of California collections.

The species of *Nereis* (sensu stricto) found in California are characterized by their posterior parapodia being provided with falcigerous homogomph notosetae (fig. 46, *d*). They can be arranged in series based on the relative proportions of the dorsal lobes of the posterior parapodia. Starting with *N. pelagica* Linnaeus, which seems most generalized, one such series would include those in which